

What is claimed is:

- 1) An isolated nucleic acid molecule consisting of the sequence shown in SEQ ID NO. 2.
- 2) An isolated nucleic acid molecule which encodes a protein comprising an amino acid sequence at least 70 % homologous to the amino acid sequence of SEQ ID NO. 1, wherein said amino acid sequence is expressed in bone tumors.
- 3) The isolated nucleic acid molecule of claim 2, comprising the nucleotide sequence of SEQ ID NO. 2.
- 4) The isolated nucleic acid molecule of claim 3, wherein the amino acid sequence is expressed in Ewing's Sarcoma family of tumors.
- 5) The isolated nucleic acid molecule of claim 3, wherein the amino acid sequence is expressed in osteosarcoma tumors.
- 6) An antisense cDNA molecule consisting of the sequence shown in SEQ ID NO 3.
- 7) An antisense cDNA molecule consisting of the sequence shown in SEQ ID NO. 4.
- 8) An antisense cDNA molecule derived from a cDNA sequence of SEQ ID NO. 2, wherein the antisense cDNA molecule is at least 1000 nucleobases in length and

produces an antisense mRNA, wherein said antisense mRNA is at least 70% complementarity to native mRNA produced by a tubedown-1 gene.

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9) The antisense cDNA molecule of claim 8, wherein the antisense mRNA and native mRNA hybridize under low and high stringency conditions.

10) The antisense cDNA molecule of claim 9, wherein the antisense cDNA molecule is selected from the group consisting of SEQ ID NO. 3 and SEQ ID NO. 4.

11) A composition comprising a safe and effective amount of an antisense cDNA molecule derived from a cDNA sequence of SEQ ID NO. 2, and a pharmaceutically acceptable carrier.

12) The composition of claim 11 wherein the antisense cDNA molecule is at least 1000 nucleobases in length, and wherein the antisense cDNA produces an antisense mRNA which is at least 70% complementarity to an mRNA produced by a native tubedown-1 gene.

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13) The composition of claim 12 wherein the antisense mRNA and native mRNA hybridize under low and high stringency conditions.

14) The composition of claim 13 wherein the antisense cDNA is selected from the group consisting of SEQ ID NO. 3 and SEQ ID NO. 4.

15) A method of providing biologically active antisense cDNA derived from a cDNA sequence of SEQ ID NO. 2, to cells of an individual producing excess of a tubedown-1 gene, said method comprising in vivo administration into cells a vector comprising and expressing the antisense cDNA which produces an antisense mRNA, which binds to native mRNA produced by the tubedown-1 gene, thereby blocking expression of said gene.

16) The method of claim 15 wherein the antisense cDNA molecule generates antisense mRNA of at least 70% complementarity to mRNA produced by a native tubedown-1 gene.

17) The method of claim 16 wherein the antisense mRNA and native mRNA hybridize under low and high stringency conditions.

18) The method of claim 17 wherein the antisense cDNA molecule is selected from the group consisting of SEQ ID NO. 3 and SEQ ID NO. 4.

19) The method of claim 17 wherein the vector is a viral vector.

20) The method of claim 19 wherein the viral vector is selected from the group consisting of a lentivirus, adenovirus, adeno-associated virus and virus-like vectors.

21) The method of claim 17 wherein the vector is a plasmid.

22) A method for treatment of osteosarcoma in a mammal, said method comprising administering to said mammal a safe and effective amount of an antisense cDNA molecule derived from a cDNA molecule of SEQ ID NO. 2 sufficient to treat said condition.

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23) The method of claim 22, wherein the antisense cDNA molecule is selected from the group consisting of SEQ ID NO. 3 and SEQ ID NO. 4 and mixtures thereof.

24) The method of claim 23 wherein said method further comprises generation of the antisense cDNA ex vivo which, when introduced into the cell, causes inhibition of expression of a tubedown-1 protein by hybridizing with mRNA and genomic sequences of a tbdn-1 gene.

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25) The method of claim 24 wherein the antisense cDNA's are phosphoramidate, phosphothioate, methylphosphonate and other modified analogs of said cDNA which are resistant to endogenous nucleases.

26) The method of claim 23, wherein said method further comprises providing the antisense cDNA to cells of an individual expressing a tubedown-1 protein, said method comprising in vivo administration into cells a vector comprising and expressing the antisense cDNA which produces antisense mRNA which binds to native mRNA produced by a tubedown-1 gene, thereby inhibiting expression of said tubedown-1 protein.

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27) The method of claim 26 wherein said method is used in combination with radiotherapy and other chemotherapeutic treatments.

28) A method for treatment of Ewing's Sarcoma family of tumors in a mammal, said method comprising administering to said mammal a safe and effective amount of an antisense cDNA derived from a cDNA molecule of SEQ ID NO. 2 sufficient to treat said condition.

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29) The method of claim 28, wherein the antisense cDNA is selected from the group consisting of SEQ ID NO. 3 and SEQ ID NO. 4 and mixtures thereof.

30) The method of claim 29 wherein said method further comprises generation of the antisense oligonucleotide ex vivo which, when introduced into the cell, causes inhibition of expression of a tubedown-1 protein by hybridizing with mRNA and genomic sequences of a tbdn-1 gene.

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31) The method of claim 30 wherein the antisense cDNA molecules are phosphoramidate, phosphothioate, methylphosphonate and other modified analogs of said cDNA molecules which are resistant to endogenous nucleases.

32) The method of claim 29 wherein said method further comprises providing the antisense cDNA's to cells of an individual expressing a tubedown-1 protein, said method comprising in vivo administration into cells a vector comprising and expressing the antisense cDNA's which produces antisense mRNA that binds to

- 5 native mRNA produced by a tubedown-1 gene, thereby inhibiting expression of said tubedown-1 protein.

33) The method of claim 32 wherein said method is used in combination with radiotherapy and other chemotherapeutic treatments.

34) A method of inhibiting expression of a tubedown-1 protein in cells or tissues comprising contacting said cells or tissue in vitro with the antisense cDNA of claim 8 so that expression of said tbdn-1 protein is inhibited.

35) A method of inhibiting expression of a tubedown-1 protein in cells or tissues comprising contacting said cells or tissue in vitro with biological or chemical factors so that expression of said tbdn-1 protein is inhibited.

36) A replicable vector which comprises the antisense cDNA of claim 10.

37) A host cell which comprises the vector of claim 36.

38) The host cell of claim 37 wherein the host cell is a eukaryotic cell.

39) The host cell of claim 37 wherein the host cell is a bacterial cell.

40) The vector of claim 36 wherein the vector is a plasmid.

41) A single-stranded antisense oligonucleotide derived from an antisense cDNA sequence of SEQ ID NO. 3 or 4, wherein the antisense oligonucleotide is at least 15 nucleobases in length and is of at least 70% complementarity to a native mRNA produced by a tubedown-1 gene.

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42) The antisense oligonucleotide molecule of claim 41, wherein the antisense oligonucleotide and native mRNA hybridize under low and high stringency conditions.

43) A composition comprising a safe and effective amount of a single-stranded antisense oligonucleotide at least 15 nucleobases in length derived from an antisense cDNA sequence of SEQ ID NO. 3 or 4, and a pharmaceutically acceptable carrier.

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44) The composition of claim 43 wherein the antisense oligonucleotide is of at least 70% complementarity to mRNA produced by a native tubedown-1 gene.

45) The composition of claim 44 wherein the antisense oligonucleotide and native mRNA hybridize under low and high stringency conditions.

46) A method for treatment of osteosarcoma in a mammal, said method comprising administering to said mammal a safe and effective amount of a single-stranded antisense oligonucleotide at least 15 nucleobases in length, derived from an antisense cDNA molecule of SEQ ID NO. 3 or 4, sufficient to treat said condition.

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47) The method of claim 46 wherein the antisense oligonucleotides are phosphoramidate, phosphothioate, methylphosphonate and other modified analogs of said oligonucleotide which are resistant to endogenous nucleases.

48) The method of claim 47 wherein said method further comprises generation of the antisense oligonucleotide ex vivo which, when introduced into the cell, causes inhibition of expression of a tubedown-1 protein by hybridizing with mRNA and genomic sequences of a tbdn-1 gene.

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49) A method for treatment of Ewing's Sarcoma family of tumors in a mammal, said method comprising administering to said mammal a safe and effective amount of a single-stranded antisense oligonucleotide at least 15 nucleobases in length, derived from an antisense cDNA molecule of SEQ ID NO. 3 or 4, sufficient to treat said condition.

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